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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2004903000 for a patent by SAVE THE WORLD AIR, INC. as filed on 04 June 2004.

WITNESS my hand this
Fourteenth day of January 2005

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Title

Inline Exhaust Device to Improve Efficiency of a Catalytic Converter

Field of the Invention.

This invention is directed to a device that can sit within an exhaust stream of an internal combustion vehicle and which can improve the efficiency of the catalytic converter in the exhaust stream.

Background Art.

Internal combustion engines such as gasoline or petrol engines provide toxic emissions which contain carbon monoxide, nitrogen oxides and the like.

One way by which these toxic emissions can be reduced is to provide a catalytic converter in the exhaust stream. A common catalytic converter is a three-way converter that reduces the three regulated emissions - carbon monoxide, VOC's, and nitrogen oxides. The catalytic converter typically uses two different types of catalysts, being a reduction catalyst and an oxidation catalyst. The converter usually comprises a honeycomb of ceramic or metal structure which is coated with a metal catalyst which is typically platinum, palladium or rhodium.

One of the biggest shortcomings of the catalytic converters is that they only work efficiently at fairly high temperature. One simple way to keep the catalytic converter hot is to make sure that the converter is positioned upstream in the exhaust system and close to the engine. However, this is not always convenient and can result in the catalytic converter becoming too hot which will cause damage to the catalytic converter.

Thus, it is also known to preheat the catalytic converter. This is commonly done using an electric preheating element which is powered from the vehicle battery and which heats the catalytic converter to the operating temperature. During normal operation of the engine, the heat of the exhaust gases is usually sufficient to keep the catalytic converter at its operating temperature, and the preheating element can then be switched off. However, an electric preheater still requires several minutes of

operation to heat the catalyst to the operating temperature. Also, the preheater can create a considerable power drain to the battery, and will not be suitable for engines that do not have a battery (such as lawnmower engines).

Another major operational problem with inline catalytic converters is that the converter temperature can drop below an operating level when the engine is idling. For instance, if the vehicle is in heavy traffic, or is stopped by a red traffic light, the engine revolutions decrease to idling speed. This causes the temperature of the exhaust gases to quickly drop to a level where the temperature does not properly maintain the catalytic converter in its operational temperature zone.

Therefore, there would be an advantage if it were possible to provide some means which can maintain the catalytic converter in its operational temperature zone for a longer period of time than would otherwise be possible especially if the engine speed reduces (for instance is idling).

It will be clearly understood that, if a prior art publication is referred to herein, this reference does not constitute an admission that the publication forms part of the common general knowledge in the art in Australia or in any other country.

Object of the Invention.

It is an object of the invention to provide an inline exhaust device that can improve the working of a catalytic converter and which may overcome at least some of the above-mentioned disadvantages or provide a useful or commercial choice.

In a broad form, the invention comprises a device to improve the working of an inline catalytic converter, the device comprising an internal profile which contacts the exhaust gasses and absorbs heat from the exhaust gasses. The profile may comprise or include a plurality of recesses or cavities to facilitate increased turbulence of the gasses which may improve the heat absorption.

In another form, the invention resides in a device to improve the working of an inline catalytic converter, the device comprising a plurality of cavities or spaced apart

members that extend at least partially into the exhaust stream, and adjacent the catalytic converter, the cavities or spaced apart members functioning to absorb heat from the exhaust stream and to keep at least part of the catalytic converter at an elevated temperature.

In this manner, the device can absorb heat from the hot exhaust gases when the engine is running normally and should the engine idle, and the exhaust gas temperature drop, the device can radiate or otherwise transmit heat to part of the catalytic converter, or warm part of the catalytic converter to maintain the converter at least partially in its more efficient operating temperature during the idling time. Of course, the device cannot indefinitely maintain the temperature of the catalytic converter, but it should be effective during stop/start traffic or ordinary periods of idling.

The device will typically be placed downstream from the catalyst. It may also be possible to place the device in front of the catalyst, but in some exhaust systems, the front portion can get quite hot and it may not be efficient to place the device in front of the catalyst. However, if the exhaust system is such that the catalyst is far enough away from the engine, it may be possible to place the device in front (upstream) of the catalyst as well as, or instead of, behind the catalyst.

The device is preferably configured to absorb heat from the exhaust stream but without unnecessarily creating a backpressure in the exhaust. A backpressure is not always advantageous as too much backpressure can reduce the engine power by between 20%-30% and can increase fuel consumption.

For this reason, it is preferred that the device comprises a plurality of spaced apart members that extend at least partially into the exhaust stream, at least some of the members being provided with an opening extending therethrough through which at least some of the exhaust gases can pass. It is preferred that the members extend substantially about the inner wall of the exhaust. Therefore, if the exhaust is substantially circular, it is preferred that the members comprise circular disks containing a central opening through which exhaust gases can pass. Of course, if the exhaust has a square, oval or rectangular cross-section, the shape of the members can

vary to accommodate these configurations.

The number of spaced apart members may vary depending on the size of the exhaust, the volume of exhaust gases, etc. Typically, the device will contain between 2-20 spaced apart members and preferably between 4-10 spaced apart members.

The device may comprise a sleeve to which the spaced apart members are attached. The sleeve may be designed to slide within the exhaust system to a position adjacent the catalyst. Alternatively, the sleeve may be designed to be part of the exhaust system and clamped to the exhaust or otherwise attached to the exhaust pipe. The sleeve may alternatively have another internal profile to improve heat transfer from the gasses to the device.

The spaced apart members (or other profile) may be spaced apart by a distance of between 3-50 millimetres and typically between 5-20 millimetres. A function of the spaced apart members is to create turbulence in the exhaust gas to cause part of the exhaust gas to swirl or be turbulent about and between the spaced apart members. It is considered that this improves the absorption of heat from the exhaust gases and into the spaced apart members. This can be due to increased resident time between the hot exhaust gas and the member caused by the turbulence or "eddy" effect which may function to cause the cooler gasses on the "outside" of the gas stream and which are in a heat exchange relationship with the device to be replaced by the hotter gasses in the "central" part of the gas flow, thereby causing the catalytic converter to heat up more quickly. This effect need not substantially increase the resident time of the gasses in the exhaust.

The spaced apart members will preferably be formed from materials which will be strong enough to survive in the hot exhaust gases while still being relatively efficient in absorbing heat from the gases. Metals such as steel are considered suitable. However, no limitation should be placed on the invention merely by providing steel as a suitable material from which the spaced apart members can be made. The members can be made from other suitable metals, metal alloys, sintered metals, nonmetallic heat absorbing members, composite materials and the like.

The spaced apart members will typically extend from the edge of the exhaust tube into the gas flow sufficiently to efficiently absorb heat from the gas flow without unnecessarily impeding the gas flow to create an undesirable backpressure. It is considered that the spaced apart members may extend into the exhaust tube by a distance of between 10%-80% of the area. In one embodiment, this can be achieved by having the spaced apart members comprising substantially circular disks having an opening extending therethrough with the area of the disk comprising between 10%-80% of the cross-section area of the exhaust tube.

One function of the spaced apart members is to create eddies or turbulence in at least part of the gas flow *inter alia* to improve the ability of the members to absorb heat from the gas flow. For this reason, the profile of the members may be such to improve this effect. In one form, the spaced apart members may be substantially disk-like having parallel sidewalls. However, in another form the, or each, side wall may be profiled to improve turbulence. The profile may comprise a recess or "concavity" in the or each side wall. In another form, the members may comprise a ramped surface which may extend towards or away from the catalytic converter. Other profiles and configurations are envisaged to improve the turbulence of the gas flow.

It is considered beneficial to have a spacing gap between the catalytic converter and the first member of the device. While not wishing to be bound by theory, we believe that this gap improves the ability of the heat absorbed by the device to radiate the heat (or otherwise transmit the heat) back to the catalytic converter. The gap can comprise a "heat curtain" and can be anywhere between 5 millimetres-100 millimetres and preferably about 25 millimetres.

Brief Description of the Drawings.

An embodiment of the invention will be described with reference to the following drawings in which:

Figure 1 illustrates a device positioned downstream from a catalytic converter.

Figure 2 illustrates a different profile of the spaced apart members in the device.

Figure 3 illustrates yet another profile of the spaced apart members in the device.

Figure 4 illustrates a typical exhaust system.

Best Mode.

Referring initially to figure 4, there is illustrated a typical exhaust system that extends from the invention 10 to the tailpipe 11 and which contains an inline muffler 12, a catalytic converter 13, and a device 14 according to the invention which is mounted behind (downstream) the catalytic converter 13.

Referring to figure 1, there is illustrated a device according to an embodiment of the invention. The device 14 is positioned downstream from catalytic converter 13. Hot exhaust gases from the engine pass into the front of catalytic converter 13 at a temperature of between 200°-270° centigrade (this can of course vary). At the rear end of the catalyst is a small air gap 15 having a length of about 25 millimetres. The device 14 comprises five spaced apart members 16, each member comprising a circular disk having a central aperture 17 through which the exhaust gases can pass. The central aperture 17 of each disk is aligned with the central aperture of each other disk to provide a central flow pathway 18 which is substantially unimpeded.

The disks are spaced apart by about 20 millimetres. As exhaust gas flows from catalyst 13 and through the aligned central apertures 17 of each disk, eddies and turbulence are provided about each disk causing exhaust gas to flow into the spacing between adjacent disks. This hot exhaust gas can then exchange heat with the respective disks causing the disks to heat up. This continues along the length of the device until the exhaust passes through the device and towards muffler 12.

Figures 2-3 illustrate different designs of the spaced apart members 16. The designs are to improve the edge effects between the gas and the member to cause turbulence and eddies to be formed between the spaced apart members.

The design does not increase the backpressure of the exhaust to an undesirable degree which can cause a reduction in engine power and increase in fuel consumption. It is considered that the aligned apertures in the disks enable exhaust gas to still flow

through the device, and it is considered that having the spaced apart members provides a better heat exchange.

Tests have shown that under engine idling conditions, the temperature at the front of the catalyst is about 150° and, without the device fitted, the temperature at the rear of the catalyst is about 100°. When the device is fitted, this increases the temperature at the rear of the catalyst to about 200°.

Throughout the specification and the claims (if present), unless the context requires otherwise, the term "comprise", or variations such as "comprises" or "comprising", will be understood to apply the inclusion of the stated integer or group of integers but not the exclusion of any other integer or group of integers.

Throughout the specification and claims (if present), unless the context requires otherwise, the term "substantially" or "about" will be understood to not be limited to the value for the range qualified by the terms.

It should be appreciated that various other changes and modifications can be made to any embodiment described without departing from the spirit and scope of the invention.

DATED this fourth day of June 2004

Save the World Air, Inc.

By its Patent Attorneys

Cullen & Co.

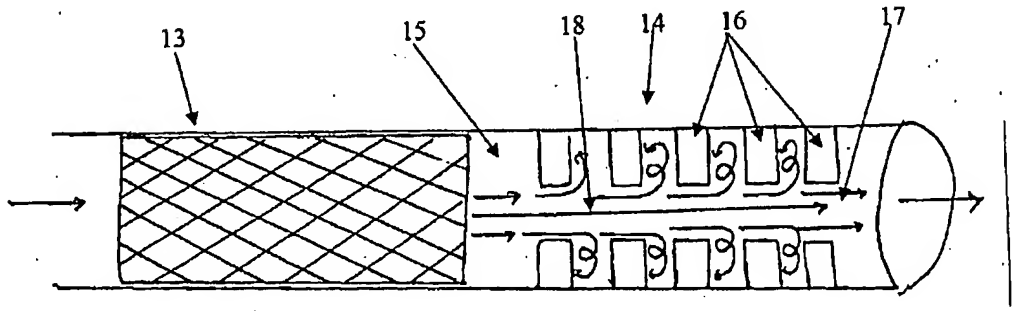

FIG 1

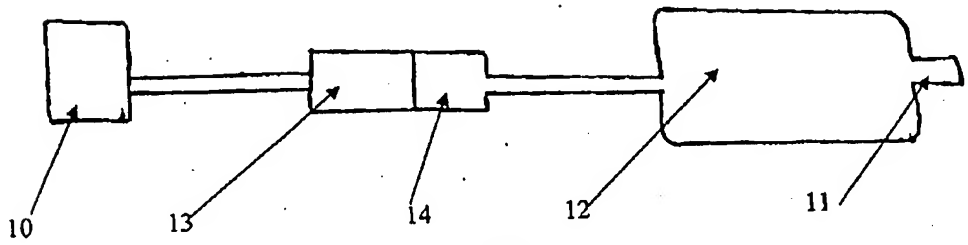

FIG 4

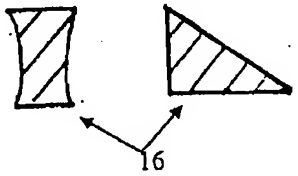

FIG 2

FIG 3